A EVALUATION METHOD FOR THE MANAGEMENT INFORMATION SYSTEMS

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Abstract

In this paper, we advance a new MIS (Management Information System) quality evaluation index (factor) system and use fuzzy multifactorial evaluations technique to establish MIS quality evaluation model, thus provides a MIS quality metrical method.

keywords: Mulifactorial evaluation, Evaluation index system.

1. Introduction

With the development of MIS science and the appearance of more and more MIS development projects, computer application workers and system managers now pay a great attention to the evaluation of MIS quality. In recent years, the evaluation of MIS quality is not only approached in terms of theory but also widely used in MIS development, management and acceptance.

The evaluation of the MIS involves a wide range of problems and requires to establish a multifactorial evaluation index (factor) system. Because the evaluation index (factor) system is very complicated; some evaluation index (factor) of the system can not be quantitatively described; each of the evaluation index (factor) of the system has its evaluation criteria; the importance of each of the evaluation indexes and factors to the result of the MIS quality evaluation is different, therefore, the evaluation of an actual MIS

requires a multifactorial evaluation model and method. Since the result of a MIS evaluation needs to be expressed only in gradational form as " A ", " B ", " C ", " D ", we think it is feasible and effective to make use of fuzzy multifactorial judgement technique to solve the MIS quality evaluation problem. This paper advances a new MIS quality evaluation index (factor) system and uses fuzzy multi-factorial judgement technique to establish a MIS quality evaluation model,thus provides an effective evaluation method overall MIS quality and its individual characteristics.

2. The Evaluation Index (Factor) System

The evaluation of MIS requires us to indentify objectives, establish criteria for measuring these objectives and measure the performance in terms of the criteria. For this reason we introduce the following metrical criterias as MIS evaluation index (factor) system .

(I) Technical Property Indexes

Index 1. Reliability

We evaluate reliability of the MIS from three respects i.e. error finding , classifying and soluting . The principal evaluation factors are

(1) testing ability, that is the ability to discover input data errors and operating errors;

(2) analysing ability, that is the ability to determine the type and the seriousness of errors;

(3) resuming ability, that is the ability to handle errors and solve problems.

Index 2. Availability

It means the quality of services for the MIS users. The principal

evaluation factors are

(1) validity of information by MIS;

(2) convenience degree for users to input and operate data;

(3) users' satisfaction degree for outputed reports.

Index 3. Maintainability

The maintenance is the activity of revising, correcting, and upgrading the MIS, in other words, maintenance of the MIS is directed toward reducing errors due to design, and environmental changes, and improving the system's services. The maintenance should last to the end of the lift cycle of MIS. The principal evaluation factors are

(1) maintainability of software (program);

(2) maintainability of data;

(3) maintainability of hardware.

Index 4. Expandability

The changes of organization, economic conditions or environment, and the development of computer technologe, application programs and the managemeat techniques require anything from routine change and expand in the MIS. The principal factors to evaluate expandability are

(1) enlargability that is the easiness degree to increase data input, store and output unmbers;

(2) alterability, that is the easiness degree to modify or add system functions.

Index 5. Processing Capability

The ptincipal factors to evaluate this index are

(1) total transactions 'processed;

(2) the speed of operation (including inputs, outputs and data comm-uncations);

(3) the numbers of data storage;

(4) the response time;

(5) the security of system .

Index 6. Resources Utilization Rate

The principal evaluation factors are

(1) mainframe utilization rate;

(2) external device utilization rate;

(3) data resources utilization rate;

(4) software utilization rate.

(II) Economic Benefit / Cost Indexes

Index 7. Immediate Economic Benefits

Immediate economic benefits mean the economic benefits can be quantitatively described.These may include decrease in product design cycle; shorter delivery time; reduced loss of orders; increase productive output; improvement of product quality etc.. The system costs include procurement cost, start-up cost, project-related cost and maintenance cost,such as,consulting cost,equipment purchase cost, equipment installation cost, cost of system software,cost of personel searches activities, cost of data collection, cost for training user personnel in application use, system hardware and software maintenance cost etc.. The factors to evaluate immediate benefit/cost are

(1) increaseing appropriate of the productive capacity / system cost;

(2) reducing appropriate of the productive cost / system cost;

(3) improving appropriate of the quality of products / system cost;

(4) speeding up appropriate of circulating fund furnover rate/system cost;

(5) reducing appropriate of the nonproductive expenditure/system cost.

Index 8. Indirect Economic Benefits

The indirect economic benefits mean the economic benefits cannot be quantitatively described. Indirect benefit factors may include

(1) improved management level for fundamental data;

(2) improved intraorganizational relationships;

(3) improved effectiveness in the function of the operating systems;

(4) more timely and better quality information for managers, both external and internal;

(5) freeing of managerial time for higher-level contributions;

(6) reduction in errors because of greater standardization and better procedures and policies;

(7) greater work satisfaction for more personels.

3. Mathematics Model

Let MIS quality evaluation indexes (first level) of above system be $a_1, \ldots, a_8$.

Let evaluation factors (second level) of MIS quality evaluation index a_i ($i=1,2,\ldots,8$), be $b_{i1}, b_{i2}, \ldots, b_{i(j)}$, and call

$$V=\{ b_{ij} ; i=1,2,\ldots,8, j=1,2,\ldots,j(i) \}$$

evaluation factor set.

We establish mark set according to the requirement. In this paper, mark set is

$$U=\{ A,B,C,D \}.$$

Let weight of a_i be x_i $(i=1,2,\ldots,8)$ and write

$$X=(x_1, x_2, \ldots, x_8),$$

where $x_i \geqslant 0$, for the purpose of simplifing calculating process, let $x_i \leqslant 1$, $(i=1,2,\ldots,8)$, $\Sigma x_i = 1$.

Similarly, let weight of each evaluation factor b_{ij} of evaluation index

a_i $(i=1,2,\ldots,8)$ be y_{ij} $(j=1,2,\ldots,j(i))$ and write

$$Y_i=(y_{i1},y_{i2},\ldots,y_{ij(i)}) \quad i=1,2,\ldots,8.$$

where, $0 \leqslant y_{ij} \leqslant 1$ and $\sum\sum y_{ij} = 1$.

On the basis of above-mentioned, we follow the steps below to MIS quality evaluation.

(I) Choose One Element of Mark Set for Each Evaluation Factor b_{ij} $(i = 1,2,\ldots,8,\ j = 1,2,\ldots j(i))$

Each expert in MIS quality evalation group choose any one element of mark set U for each evaluation factor b_{ij} $(i=1,2,\ldots,8,\ j=1,2,\ldots,j(i))$, then calculate subordinate degree of each mark of b_{ij}, i.e. the proportion of each mark of b_{ij}

$$r_{ij}=(r^1_{ij},r^2_{ij},r^3_{ij},r^4_{ij}) \qquad i=1,2,\ldots,8, \quad j=1,2,\ldots,j(i),$$

where r^1_{ij}, r^2_{ij}, r^3_{ij}, r^4_{ij} are on behalf of the proportions that mark of b_{ij} is A, B, C, D respectively.

(II) Determine the Mark of Each Evaluation Index a_i $(i=1,2,\ldots,8)$

Evaluation matrix of evaluation index a_i be written

$$R_i = \begin{bmatrix} r_{i1} \\ \vdots \\ r_{ij(i)} \end{bmatrix} = \begin{bmatrix} r^1_{i1} & \cdots & r^4_{i1} \\ \vdots & \cdots & \vdots \\ r^1_{ij(i)} & \cdots & r^4_{ij(i)} \end{bmatrix} \qquad i=1,2,\ldots,8,$$

then we make fuzzy matrix opration of R_i and Y_i $(i=1,2,\ldots,8)$ and obtain evaluation result for a_i

$$N_i=Y_i \circ R_i$$

$$=\left(\overset{j(i)}{\underset{j=1}{\overset{*}{\cdot}}}(y_{ij} \overset{*}{\cdot} r^1_{ij}),\ \overset{j(i)}{\underset{j=1}{\overset{*}{\cdot}}}(y_{ij} \overset{*}{\cdot} r^2_{ij}),\ldots,\ \overset{j(i)}{\underset{j=1}{\overset{*}{\cdot}}}(y_{ij} \overset{*}{\cdot} r^4_{ij})\right)$$

$$=(n^1_i,\ n^2_i,\ n^3_i,\ n^4_i) \qquad i=1,2,\ldots 8,$$

where n^1_i represents the proportion that mark of a_i is A. Thereform, we extract

$$\tilde{n}_i = \max(n^1_i,\ n^2_i,\ n^3_i,\ n^4_i) \qquad i=1,2,\ldots 8,$$

the mark corresponding to the $\tilde{n}_i$ is evaluation result for index a_i .

(III) Determine Mark of Overall MIS Quality

We establish overall MIS quality evaluation matrix

$$N = \begin{bmatrix} N_1 \\ \vdots \\ N_8 \end{bmatrix} = \begin{bmatrix} n_1^1 & \cdots & n_1^4 \\ & \cdots & \\ n_8^1 & \cdots & n_8^4 \end{bmatrix}$$

then make fuzzy matrix operation of N and X and obtain evaluation result of overall MIS quality

$$M = X \circ N$$

$$= \left(\overset{8}{\underset{i=1}{*}} (x_i \dot{*} n_i^1), \overset{8}{\underset{i=1}{*}} (x_i \dot{*} n_i^2), \ldots, \overset{8}{\underset{i=1}{*}} (x_i \dot{*} n_i^4) \right)$$

$$= (m_1, m_2, m_3, m_4)$$

where m_1 represents the proportion that mark of overall software quality is A. Therefore, we obtain

$$\tilde{m} = \max (m_1, m_2, \ldots, m_4),$$

the mark corresponding to the $\tilde{m}$ is mark of overall MIS quality.

(IV) Compare and Appraise the MIS Qualities of Different Types

When some MIS of different types need comparing and appraising, firstly, we want to determine the weight of each evaluation index and each evaluation factor on type of MIS. If a factor (or index) is important for the MIS of certain type, then the factor must have a big weight. If a factor is of no importance for a MIS of certain type, then the weight of this factor can be quite small or zero. Secondly, according to evaluation factor set and mark set we choose marks for every factors and calculate subordinate degree, thus obtain evaluation result of individual characteristics of each MIS

$$N_i = (n_i^1, n_i^2, n_i^3, n_i^4) \qquad i = 1,2,\ldots,8$$

and evaluation result of overall MIS quality

$$M = (m_1, m_2, m_3, m_4)$$

Lastly, compare n_i^1 $(i=1,2,\ldots,8)$ of every MIS, the MIS corresponding to the greatest n_i^1 is the best in the individual quality, compare m_1 of every MIS, the MIS corresponding to the greatest m_1 is the bestin oveall quality.

In this paper, the operational symbol $\dot{*}$ and $\ddot{*}$ can represent different calculations, i.e. various mathematics models can be made by model $M(\dot{*}, \ddot{*})$, for example, $M(\wedge(\min), \vee(\max))$, $M(\cdot, \vee)$ and $M(\cdot, +)$.

4. Conclusion

The model overcomes some one_sidednesses and weaknesses of former MIS evaluation methods and raises scientific property of MIS evaluation. Not only can the model be used to grade the MIS on the basis of its quality (for example, meeting of appraise the MIS quality) , but it also can be used to compare and appraise the qualities of different MIS (for example, decide on awards through discussion for different MIS), it has good practical value.

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